National Aeronautics and Space Administration

Office of Aerospace Technology
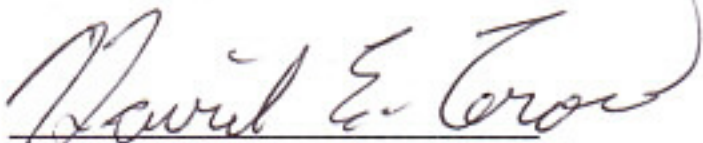
Revolutionize Aviation Subcommittee
of the Aerospace Technology Advisory Committee

February 25, 2003

Holiday Inn, 550 C Street, S.W., Washington, D.C.

MEETING REPORT

Terrence J. Hertz   (date) 6/25/03
Terrence J. Hertz   (date)
Executive Secretary

David E. Crow
David E. Crow   (date)
Chair

REVOLUTIONIZE AVIATION SUBCOMMITTEE REPORT

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Meeting Report Prepared by:
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REVOLUTIONIZE AVIATION SUBCOMMITTEE
MEETING MINUTES

Introduction

Welcome Remarks from Chair

Terry Hertz convened the meeting at 8:20 a.m. and since the designated Chair Ed Crow was attending via teleconference, Ronald Swanda was assigned Acting Chair for the purpose of this meeting.

Ed Crow outlined the subcommittee's tasks: to understand the programs, where the customers were, and how to meet customer and NASA needs. He was proud of the significant progress achieved by the RAS working groups to date, and stated that NASA and the FAA need a common vision on working on the Air Traffic Control infrastructure. A joint meeting with the FAA Research Engineering and Development Advisory Committee (REDAC) is planned for September.

In October, the ATAC approved the work the RAS working groups were doing. The reorganized Aerospace Technology Enterprise has four theme areas (Aeronautics Technology, Space Launch Initiative, Mission and Science Measurement Technology, and Innovative Technology Transfer Partnerships) as depicted in the recently released 2003 NASA Strategic Plan. Program plans flow directly down from NASA's Strategic Plan and Vision.

Review Actions from Last Meeting and NASA Response

Terry Hertz reported on the progress of action items from the last meeting. **He and Ed Crow are still working on inviting Bill Wirth to join the RAS[1]. Ronald Swanda offered to help identify a representative from Aircraft Owners and Pilots Association who could be added to the RAS membership[2].** No comments were received from subcommittee members on NASA's Vision and Mission, Aeronautics Strategic Goals, or Revolutionize Aviation objectives. Subcommittee working groups will be critiquing the Aeronautics Technology programs.

On his action item, John O'Brien reported that the Commercial Aviation Safety Team (CAST) Executive Committee met twice, including once that day. They approved of safety enhancements and identified those that NASA is or should be working on. Based on the current economic climate, CAST was not prepared to initiate new safety recommendations. NASA works in partnership with the FAA on approach and landing, flight training, and runway incursions.

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[1] Terry Hertz/Ed Crow
[2] Ronald Swanda

Ed Crow reported that the task to write a White Paper on the European Unions' Vision for 2020 for the ATAC was satisfied by an oral report on work that had already been done. The vision looks a lot like NASA's goals. The difference is they think they're going to achieve them. Terry Hertz reported that NASA is hiring a consultant to analyze European Union' Vision for 2020 and find out how much money is really being invested in it. They will share that report when finished.

Section I. Subcommittee Presentations

Aviation Safety Working Group

John O'Brien proposed using existing safety committees and getting the Aviation Safety Program Executive Council (AvSPEC) (established August 5, 1999, following a White House commission on safety and security) formally into the advisory committee structure to support RAS. He is working on how to use the new safety working group to rework aviation safety goals to be more powerful, capabilities-based goals. He presented a list of current working group members and **recommended continuation of the working group but stated that the membership would change if it is to include security[3]. He also recommended aviation safety be placed on the agenda for the next ATAC meeting to report out on the results of the AvSPEC meeting to be held March 19-20[4].**

Airspace Systems Working Group

John Hansman's Working Group focused on the original set of 5 questions provided by the RAS. They reviewed four projects including the Advanced Air Transportation Technologies (AATT), Small Aircraft Transportation System (SATS), Virtual Airspace Modeling and Simulation (VAMS), and Airspace Operations Systems (AOS).   He presented the working group's members and their participation in the review.

The team's overall assessment was that the Airspace Systems Program goal was relevant and would increase in importance as the economy recovered. The team felt the goal should include an understanding of the current NAS and an assessment of future demands on the system. He stated the goal is revolutionary, but implementation is evolutionary, so there needs to be a balanced portfolio between short-term and long-term investments because there is a tendency to sacrifice long-term objectives. The team approved of Airspace Systems Program Objectives 1, 3, and 4 but stated that Objective 2 (General Aviation and Runway Independent Aircraft) was unclear. There could be tighter linkage from theme objectives down to program objectives and project goals**.** There is some overlap in goals between Airspace Systems and Vehicle Systems and possibly some crosscutting issues such as Human Factors which may need to be addressed overall by the subcommittee. John Hansman stated we should not ask if the strategy is correct to achieve the goal but whether the technology is correct to achieve the goal.

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[3] John O'Brien
[4] John O'Brien

The working group strongly supported the Airspace Systems Program as a vital part of the National Capability in Air Transportation. NASA has a major research responsibility for NAS modernization. NASA has made significant contributions, particularly in mature projects like AATT and AOS and trajectory modeling and planning tools to support Air Traffic Control (ATC). NASA has developed a good working relationship with the research and operational community, but it took a long time and needs to be sustained. Five-year programs make it difficult to impact ATM systems which have 20-year transition time constraints.

John Hansman presented a detailed analysis of each of the four Airspace Systems projects. For AATT, labor groups were resistant because of the focus on automation. Since AATT was originally centered on Air Traffic Control tools, AATT never developed a "systems objective." Relationships continue to need fostering—between NASA and FAA and other groups like industry, the airlines, MITRE, Lincoln Lab, and National Air Traffic Controllers Association (NATCA). A transition plan is needed to get products to our customers. For AATT, technologies have been integrated into the FAA Operational Evolution Plan (OEP) although it is unclear what the process is on how technologies get added to that plan. There were some issues with technology transfer including the need for customer involvement and resources early and during transition. Resources for transitioning technologies need to be planned for upfront, otherwise implementation can siphon off intellectual and financial resources away from long-term work.

The team found the SATS project goal "to enable the use of over 5,000 small airports" too broad and stated that could be because it has too many constituencies. The goal should be more focused on a specific vision and suggested including SATS operations capability. The need for a sustained level of core competency even after projects come to a conclusion was reemphasized. There were concerns that the SATS' goal might adversely affect other airspace and mobility goals. Also, the rationale for the demonstrations and the key questions to be addressed were not clearly identified. There were specific integrity concerns raised about the Airport Management Module. The team strongly supported the goal of assessing economic viability, but cautioned the technology would have to push the envelope. Over-simplified approaches might mislead. Overall, there is good coordination between NASA and participating state governments, industry, and research partners through the SATS Alliance. While NASA and FAA coordinate at the REDAC level, FAA's commitment is limited by other priorities. The SATS project may be answering to too many constituencies with resources spread too thin. There needs to be a plan for transition after technology demonstration. Key regulatory and operational elements at the FAA need to be sufficiently engaged to identify barriers to implementing the SATS vision.

The team found the VAMS goal relevant but stated the objectives needed to be more clearly defined. They suggested adding "improved understanding of the current NAS" and suggested rescoping objective 1 to assess key issues in operational concepts. There was concern that advertising the VAMS as a model of the whole system would

propagate unrealistic expectations, and that the project needed to define its parameters. A methodology for synthesizing multiple independent concepts, decision points, robustness, and the influence of external forces on the system needs to be developed. The team had detailed suggestions on the modeling approach. There was concern that the FAA had not bought into NASA's modeling efforts, which would be necessary to assess concepts, methods, and tools to support the nation's air traffic modernization needs. There was also a question on whether VAMS has support from industry.

Ron Swanda had mixed feelings about VAMS. The FAA thinks it already has VAMS. The problem with modeling is there is no super model. Models are developed to answer a question. VAMS doesn't have clearly articulated objectives because the modeling has come before developing procedures. Terry Hertz said VAMS is supposed to be a model that looks at the system as opposed to narrow areas. But the parameters of "whole system" need to be clarified. Building any model requires making assumptions and scoping the boundaries of its verisimilitude. The risk is using a model inappropriately and getting misleading results.

For AOS, the team found the goals relevant. They recommended including human considerations early in design. The current technology approach is dependent on specific personal expertise in particular areas and came to the conclusion that knowledge is as important as technology. A strategic planning effort and intellectual renewal plan may be necessary to insure nationally recognized expertise into the future. At issue is the question of maintaining NASA's leadership role in aviation human factors. Historically, aviation human factors has been a NASA core competency available as a national resource. The coordination and integration of the players in this area are excellent based on NASA's reputation and credibility. Human factors was assessed by the Airspace Systems Working Group but has not been reviewed by the Aviation Safety Working Group and there may be some overlapping or crosscutting issues that need to be addressed by the subcommittee as a whole.

The subcommittee discussed a number of issues.

1. The resistance to automation was a generic problem. To transition technology, implementers have to understand the culture they are trying to change. NASA is removed from operational issues and culture. In air traffic control, there is the "safety veto." Anything unwanted is declared "not safe." Controllers do not have efficiency goals; they have safety and work load issues. The solution is to anticipate the criticism and have the real data to push back. Demonstrate the capability of a technology, but take it the next step to make sure it addresses real needs.

2. The subcommittee discussed transferring technologies. The philosophy is that NASA develops technologies to Technology Readiness Level (TRL) 6 and the operational agency takes over. But there needs to be a knowledge transfer, a wedge that supports transition at about a 70/30 percent level, research to transition. The Office of Management and the

Budget (OMB) forces NASA into concentrated efforts. Five-year programs were an OMB compromise on programs that go on forever. Core competencies need to be maintained even under this structure and during stress.

3. If NASA doesn't, the European Union will define future aircraft control systems. There is a lower barrier to entry for technology in Europe, but the United States has a comprehensive system across the nation as a whole. The FAA falls down in implementation compared with Europe.

4. **John Hansman agreed to summarize his working group's findings and recommendations so NASA can respond to each item at the next subcommittee meeting[5].**

5. **Terry Hertz agreed to revisit the makeup (i.e., representation) of the working groups and to recheck the FACA regulations on what constitutes working groups[6].**

Vehicle Systems Working Group

Mark Anderson stated his working group redefined their original task to be more responsive to NASA's by providing real-time, direct inputs to the Vehicle Systems Strategy Team on their replanning process (see page 6 of his presentation). He reviewed the working group's membership.

He stated that it would be interesting to see an analysis of what technologies were incorporated in military/commercial aviation vehicles to date. The working group endorsed the goal "To ensure the preeminence of the United States in Aeronautical Vehicle Technology" and the use of concept vehicles for demonstrations even though they may never make it to the commercial sector. In reference to the proposed five vehicle classes, the working group recommended NASA emphasize two successful examples in the advocacy of the program. The subcommittee discussed how the 48 challenges would be narrowed to 10, with the highest technology benefits with the biggest payoffs making the final 10. The working group was looking forward to seeing how their discussions may have influenced the vehicle systems replanning which was scheduled to be presented to the ATAC the next day. The subcommittee noted the need for a systems and avionics representative on the "Red Team" and endorsed the continuation of this working group.

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[5] John Hansman
[6] Terry Hertz

Aeronautics Technology Theme Update

  During his status update on the FY 2004 budget, Terry Hertz pointed out that the theme has changed from Revolutionize Aviation to Aeronautics Technology; and Aeronautics Technology has added a new objective entitled "Explore Revolutionary Aeronautical Concepts." **Mark Anderson suggested changing the subcommittee's name to be consistent with the theme change**[7].

  Aeronautics Technology has three programs: Aviation Safety and Security, Airspace Systems, and Vehicle Systems. The budget for FY 2003 showed the change from Budget As Usual (BAU) to full-cost accounting. The subcommittee discussed the definition of full-cost accounting. Between FY 2003 and FY 2004, the biggest changes reviewed were:
- A new initiative under Aviation Safety and Security to augment aviation security technologies.
- The NASA Exploratory Technologies for the NAS (NExTNAS) is a large new initiative in Airspace Systems.
- And, under Vehicle Systems, another new initiative for getting routine access in the National Airspace Systems (NAS) for Unmanned Aerial Vehicles (UAV's).

  In Aviation Safety and Security, the Synthetic Vision project was reduced because industry application occurred faster than anticipated reducing the need to invest in maturing those technologies. System-Wide Accident Prevention funds were redirected to a security focus. Crashworthiness activities were reduced based on prioritization.

  In Airspace Systems, money was taken from Vehicle Systems Program for NExTNAS. The SATS and AATT projects had planned ramp ups. To guide NAS efforts, NASA is proposing a Joint Program Office with the FAA. Andres Zellweger will be leading this activity for Code R. The Joint Program Office will include agency administrators on the Executive Committee. DDR&E, the Office of Aviation Policy, and DOD would join in activities. NASA's role would include looking at system-level concepts (VAMS), tools for airspace design and assessment, and system technologies. Their exploratory technologies for the NAS project include space-based communications and surveillance interoperability, wake vortex, air traffic management automation, and dynamic airborne procedures decision support tools. They are looking at technologies for the airspace system beyond 2020 that will enable an integrated system of all users of the NAS.

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[7] Mark Anderson

The most significant changes have occurred in Vehicle Systems. The program took a large reduction. The Hyper-X project concludes with X-43A winding down. Environmental Research Aircraft and Sensor Technology (ERAST) flight research concludes. Advanced Vehicle Concepts and Breakthough Vehicle Technology projects were cut. Some money was added to Quiet Aircraft Technology, reflecting a higher priority. John Hansman asked why UAV's in NAS were bookkept under Vehicle Systems rather than Airspace Systems. There was also some discussion on whether FAA supports UAV's.

The subcommittee discussed the ACCESS-5 group that has formed to gain access to the NAS in the next 5 years with a process for flight certification in 30-60 days. NASA's initiative focuses more on UAV's than general aviation.

The Larson Bill in the House and Allen Bill in the Senate may be an opportunity for Aeronautics. Dell Ricks (LaRC) has been asked to analyze the bill but a precursory review shows the bill specifically supports subsonic and supersonic transport, rotorcraft, aviation weather research, and air traffic management. The expanded definition of public good for mobility includes affordability. John Hansman supported the expanded definition, but thought it might be a mistake to correlate it with ticket prices in this climate of airline bankruptcies**.**

The Vehicle Systems program has 30 percent procurement out-of-house, 18 percent civil service/contractors, and the rest Center General and Administrative and Service Pools. Vehicle Systems has been asked to identify areas that can be reduced. They are looking at wind tunnels.

NASA has been asked to testify before Congress on February 27, 2003, on the *Final Report of the Commission on the Future of the United States Aerospace Industry*. Ronald Swanda stated if Congress is willing to increase NASA's budget, then where would NASA recommend the increase be and how much would they ask for.

Following up on the previous investment discussion, John Hansman stated that some of the goals are written around what we would like to do rather than what problem we are trying to address**.** There was also a discussion on maintaining a 30 percent core competency levels and how Vehicle Systems has a history of lower Technology Readiness Levels (TRL's) because many of its projects were base programs compared to Aviation Safety which had a higher TRL because its been a focused program.

Section II. Subcommittee Discussion

<u>Discussion on Integrated Results of Working Groups</u>

There was discussion of VAMS and NASA's role in NAS compared with the FAA. There was some skepticism about the FAA being open with the information needed to understand the dynamics of the NAS system. AATT is also looking at some real issues that need to be worked through the FAA. The issue with VAMS was the definition of the concept. The implication that VAMS is looking at the whole, big picture will create expectations that cannot be met. NASA needs to clarify VAMS assessment objective 3.

John Hansman recommended his working group continue. Identification of key issues and operational concepts should be what leads the model development. He recommended a more detailed review of the technical modeling effort. John Hansman will clarify his team's findings and recommendations for NASA's response with Frank Aguilera.

Mark Anderson recommended continuing his working group. He would like to augment the team with an avionics/IT person and possibly another military person.

The subcommittee identified flight software as a key technology enabler. Certifying avionics in the future is a hard problem. NASA should look at areas where they might contribute like certification risk reduction, a software tool that would allow innovators to certify software to FAA standards, or applying engineering for complex systems to software certification.

<u>SATS Subcommittee Update</u>

Ron Swanda reported that he is proposing that the SATS subcommittee be disbanded. They will work the legislative issues with the ATAC. It is important to develop what happens after SATS. An ad hoc group will perform an implementation review of the SATS in June. Ron Swanda and John Hansman will attend and write up a report. Terry Hertz requested a couple-page summary from John Hansman's assessment of SATS to satisfy the reporting requirement.

<u>Action Summary</u>

Subcommittee & Working Group Membership

1. Terry Hertz and Ed Crow are still working on inviting Bill Wirth to join the RAS.

2. Ronald Swanda offered to help identify a representative from Aircraft Owners and Pilots Association who could be added to the RAS membership

3. John O'Brien presented a list of current working group members and recommended continuation of the working group but stated that the membership would change if it is to include security.

6. Terry Hertz agreed to revisit the makeup (i.e., representation) of the working groups and to recheck the FACA regulations on what constitutes working groups.

Working Group Findings & Recommendations

5. Airspace Systems - John Hansman agreed to summarize his working group's findings and recommendations so NASA can respond to each item at the next subcommittee meeting.

Overall (Generic)

4. John O'Brien also recommended aviation safety be placed on the agenda for the next ATAC meeting to report out on the results of the AvSPEC meeting to be held March 19-20.

7. Mark Anderson suggested changing the subcommittee's name to be consistent with the theme change

APPENDIX A

AGENDA

Revolutionize Aviation Subcommittee Meeting
Holiday Inn, 550 C St., SW, Washington DC
"Discovery II" Conference Room
February 25, 2003

8:00 – 8:30	Welcome Remarks from Chair	Ed Crow
	- New Members	
	- Review Agenda/Logistics	
	- Feedback from Oct 1 ATAC Meeting	
8:30 – 9:00	Review Actions from Last Meeting & NASA Response	Terry Hertz
9:00 - 10:00	Aviation Safety Working Group	John O'Brien
10:00 – 11:00	Airspace Systems Working Group	John Hansman
11:00 – 12:00	Vehicle Systems Working Group	Mark Anderson
12:00 – 1:00	Lunch	
1:00 – 2:00	Aeronautics Technology Update	Terry Hertz
	- NASA Strategic Plan	
	- Aeronautics Technology Objectives	
	- FY 04 President's Budget	
2:00 - 3:00	Discussion on Integrated Results of Working Groups	Ed Crow
3:00 – 3:30	SATS Update	Ronald Swanda
3:30 – 4:00	Next Steps/Action Summary	Ed Crow

APPENDIX B
REVOLUTIONIZE AVIATION SUBCOMMITTEE
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APPENDIX C
MEETING ATTENDEES

Committee Members

Mark Anderson	Boeing
William Borger	AFRL
John Hamsman, Jr.	MIT
Wes Timmons (substituting for Chris Hart)	FAA
Ron Klapproth (substituting for Mike Benzakein)	GE Aircraft Engine
Mark Miller	Silorsky
John O'Brien	ALPA
Ron Swanda	GAMA
Rick Trusis	Gulfstream

NASA Attendees

Frank Aguilera	NASA
George Finelli	NASA Headquarters
Ralph A. Harrel	NASA Headquarters
Terrence Hertz	NASA Headquarters
Jerry Newson	NASA Langley
George Price	NASA Headquarters
Dell Ricks	NASA Langley

Other Attendees

Phil Carrigan	Raytheon
Fred Messina	Raytheon

APPENDIX D
FINDINGS AND RECOMMENDATIONS

APPENDIX E
REVOLUTIONIZE AVIATION SUBCOMMITTEE
LIST OF PRESENTATION MATERIAL[8]

1) Aviation Safety Working Group, John O'Brien
2) NASA ATAC Revolutionizing Aviation Subcommittee Airspace Systems Program Task Force, John Hansman
3) Vehicle Systems Working Group, Mark Anderson
4) Aeronautics Technology Theme Update, Terrence Hertz

Other Materials:
        White Paper, John O'Brien
        Final Report of the Commission on the Future of the United States Aerospace Industry

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[8] Presentation and other materials distributed at the meeting are on file at NASA Headquarters, Code R, Washington, D.C. 20546.